

CLAIMS

1. A radio-frequency amplifier comprising:

an input-side line portion which is formed on a substrate, which has an input slot line whose one end is shorted, and which is used to input an electromagnetic-field-mode signal whose magnetic field is parallel to the input slot line into the input slot line;

an output-side line portion including an output slot line which is substantially parallel to the input slot line and whose one end is shorted; and

a transistor which includes a coplanar connecting portion in which source electrodes are arranged on both sides of a gate electrode and a drain electrode arranged along a straight line and which is mounted on the substrate such that the gate electrode is positioned on the input slot line side, that the drain electrode is positioned on the output slot line side, and that the orientation of arrangement of the gate electrode and the drain electrode is perpendicular to the input slot line and the output slot line.

2. The radio-frequency amplifier according to Claim 1,

wherein the input-side line portion includes the input slot line, a first DC cut line which branches off at almost

90 degrees from the input slot line to an edge of the substrate and which has a short stub of a predetermined length at the middle thereof, and a second DC cut line which branches off at a point far from the one end of the input slot line relative to the first DC cut line to the edge of the substrate and which has a short stub of a predetermined length at the middle thereof,

wherein the output-side line portion includes the output slot line, a third DC cut line which branches off from the output slot line in the direction opposite to the first DC cut line to an edge of the substrate and which has a short stub of a predetermined length at the middle thereof, and a fourth DC cut line which branches off at a point far from the one end of the output slot line relative to the third DC cut line in the direction opposite to the second DC cut line to the edge of the substrate and which has a short stub of a predetermined length at the middle thereof, and

wherein the transistor is mounted on the substrate such that the gate electrode of the connecting portion is connected to a first DC electrode separated by the first DC cut line and the second DC cut line of the input-side line portion and that the drain electrode is connected to a second DC electrode separated by the third DC cut line and the fourth DC cut line of the output-side line portion, so that the orientation of arrangement of the gate electrode

and the drain electrode is perpendicular to the input slot line and the output slot line, and such that the both source electrodes are connected to a ground electrode separated by the input slot line, the first DC cut line, the output slot line, and the third DC cut line.

3. The radio-frequency amplifier according to Claim 1 or 2, wherein the gate electrode and the drain electrode of the transistor are placed before the one ends of the input slot line and the output slot line, respectively, by a distance of $1/4$ wavelength.

4. The radio-frequency amplifier according to Claim 2 or 3,

wherein the short stubs of the first and second DC cut lines are placed at positions of $1/4$ wavelength from branch points of the input slot line, and

wherein the short stubs of the third and fourth DC cut lines are placed at positions of $1/4$ wavelength from branch points of the output slot line.

5. The radio-frequency amplifier according to any of Claims 1 to 4, wherein an air bridge to electrically connect the both source electrodes is provided in the connecting portion of the transistor.

6. The radio-frequency amplifier according to any of Claims 2 to 5, wherein a part of the input slot line between the first DC cut line and the second DC cut line is curved toward the output slot line side and a part of the output slot line between the third DC cut line and the fourth DC cut line is curved toward the input slot line side so that pad portions are formed on the first and second DC electrodes, and wherein the gate electrode and the drain electrode are connected to the pad portions of the first and second DC electrodes, respectively.

7. The radio-frequency amplifier according to any of Claims 2 to 6, wherein the connecting portion of the transistor faces the substrate, and wherein the gate electrode, the drain electrode, and the both source electrodes are connected to the first and second DC electrodes and the ground electrode, respectively, in a flip chip method using bumps.

8. The radio-frequency amplifier according to any of Claims 2 to 6, wherein the connecting portion of the transistor is oriented to the side opposite to the substrate, wherein the gate electrode and the drain electrode are connected to the first and second DC electrodes,

respectively, via wires, and wherein the both source electrodes are connected to the ground electrode via through holes provided in the transistor.

9. The radio-frequency amplifier according to Claim 6, wherein the connecting portion of the transistor is oriented to the side opposite to the substrate, and wherein the gate electrode, the drain electrode, and the both source electrodes are connected to the pad portions of the first and second DC electrodes and the ground electrode, respectively, via through holes provided in the transistor.

10. The radio-frequency amplifier according to any of Claims 1 to 9, wherein one or more heat-dissipating through holes are provided in a portion of the substrate corresponding to a connecting position of the transistor.

11. A radio-frequency wireless communication apparatus comprising:

a mixer to receive an intermediate-frequency signal and a local oscillation signal from a local oscillator through a slot line, convert the intermediate-frequency signal to a radio-frequency signal, and output the radio-frequency signal through a slot line;

the radio-frequency amplifier according to any of

Claims 1 to 10 to receive the radio-frequency signal from the mixer through an input slot line of an input-side line portion and amplify the signal; and

a slot antenna to transmit the radio-frequency signal output from an output slot line of an output-side line portion of the radio-frequency amplifier.

12. The radio-frequency wireless communication apparatus according to Claim 11, comprising:

the radio-frequency amplifier according to any of Claims 1 to 10 to receive a radio-frequency signal received by the slot antenna through the input slot line of the input-side line portion and amplify the radio-frequency signal; and

a mixer to receive the radio-frequency signal output from the output slot line of the output-side line portion of the radio-frequency amplifier and a local oscillation signal from the local oscillator through a slot line, convert the radio-frequency signal to an intermediate-frequency signal, and output the intermediate-frequency signal through a slot line.